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1.1 Introduction

This business case examines the economics of installing cellular location equipment (Smart Look) from a service providers perspective. The Service Provider data is based on industry average data to represent a typical Service Provider. It is designed as a reference or starting-point model for companies who are considering the Sanders line of cellular location equipment. By substituting actual company data for the illustrative Service Provider data, and modifying other elements of the case as appropriate, a company can obtain an indication of the potential value of the equipment in their specific market areas. The business case write-up and financial models can be made available to prospective customers through arrangements with Sanders Telecommunications Systems, P.O. Box 868, MAN6-3010, Nashua, NH 03060 or (603)645-5460.

1.2 Executive Summary

This business case examines the proposed deployment of Smart Look cellular location equipment in the Service Provider's cellular market areas. To evaluate the relative costs and benefits, four constructs were developed to represent the Service Provider's rural areas as well as large, medium, and small metro areas. The findings from these studies were then applied to the Service Provider's nationwide cellular network configurations and deployment plans to evaluate the total costs and benefits to the Service Provider.

2.1 The Need for Cellular Location Capability

The need for cellular location capability is driven by the following considerations:

2.2 Public Safety (interface to E-911)

There is a need for a cellular interface to E-911 which requires the ability to determine and display the location of a cellular phone calling 911. An estimated 25% of the cellular callers to 911 are unable to give their exact location resulting in delayed emergency response times and other unfortunate consequences. The FCC has stated that "E911 capability for PCS... is a matter of serious concern" and opened the possibility of requiring E911 capability for wireless services at some point in the future.

2.3 Law Enforcement

Illegally modified cellular phones have become a favorite tool of drug traffickers and other persons engaged in criminal activity. Law enforcement personnel need the capability to determine the location of such phones in order to carry out their responsibilities for law enforcement.

2.4 Fraud Detection and Control

The Cellular Telephone Industry Association estimates that fraud from cellular telephones currently exceeds $1 million/day and is growing at a rapid rate. The ability to locate stolen and illegally modified cellular phones, is critical to reducing and controlling toll fraud. Fraud results in lost revenue, both from the call carrying capacity lost to fraudulent use and from the calls that would otherwise have been made legally.

2.5 Cost Avoidance

Fraud also results in increased costs to cellular carriers in detecting the fraud, and in working with the affected long distance and international service providers as well as law enforcement personnel. Along with improving the effectiveness of law enforcement efforts, and increasing revenues, there is also the potential for reducing the Service Provider's administrative and operating costs related to working with law enforcement personnel.

2.6 Service Enhancements

In addition to meeting public safety objectives, the cellular location capability will be positioned as a service feature to users of the Service Provider's network. The existing Roadside Rescue service package, for example, will be significantly enhanced by location capability. In market areas where competing cellular carriers have not installed location equipment, the Service Provider will use the capability to further differentiate the Service Provider's quality of service from competitors. This should increase sales and reduce the churn related to frequent price-oriented promotions by competitors. In market areas where competing cellular carriers do choose to install the Sanders location equipment, the Service Provider will avoid being put at a competitive disadvantage.

The availability of location information will also enhance the Service Provider's ability to manage its cellular networks. The locations of calls will be analyzed over a period of time to determine calling patterns and identify opportunities to improve network utilization through reorientation of antennas or sectors.

3.1 Potential New Products

The capabilities provided by the Smart Look location equipment can be used by the Service Provider to provide a number of new revenue producing products and related services. In addition to generating new revenue streams, the availability of these products and services will further differentiate the Service Provider's network in those market areas where competing cellular carriers have not installed state-of-the-art location equipment and avoid being put at a competitive disadvantage in other market areas. These products are described for purposes of determining market interest and potential.

As part of our agreement with Sanders Telecommunications Systems, the Service Provider will have the right to distribute and resell certain products on a non-exclusive basis. The following products offer the potential for new revenue sources for the Service Provider.

3.2 Micro Look™

The Micro Look™ product line consists of hand-held and portable cellular locators for use by public safety and law enforcement agencies.

3.3 Vehicle Alarm Device

The Vehicle Alarm Device is a small device for installation in vehicles. Theft of the vehicle activates the device which transmits a periodic cellular signal to enable location and recovery of the stolen vehicle.

3.4 Fleet Management Device

The Fleet Management Device could be used by taxi companies, emergency medical providers, etc. to track vehicle fleets. Each fleet vehicle would be equipped with a device enabling location information to be gathered and sent to a central fleet management location.

3.5 Personal Safety Device

The Personal Safety Device is a pocket sized device that would signal an emergency and enable the approximate location of the person with the device to be determined from a central monitoring point. An emergency medical unit equipped with the Smart Look™ II or Micro Look™ mobile or handheld precision location device could then be dispatched to precisely locate the device and respond to the emergency.

4.1 Potential New Services

Sales of the products listed in the previous section could be coupled with location services to be provided by the Service Provider (or Joint Venture company) based on monthly recurring and/or usage based charges. These services are described for purposes of determining market interest and potential.

4.2 Stolen Vehicle Location Service

The Stolen Vehicle Location Service will be sold in combination with Vehicle Alarm Devices. There will be a monthly charge for monitoring along with a per incident charge when the alarm is activated.

4.3 Fleet Management Service

Fleet Management Service will be sold together with Fleet Management Devices. A monthly charge will apply for each vehicle monitored.

4.4 Personal Safety Service

The Personal Safety Service will provide the monitoring service for the users of the Personal Safety Device. A monthly charge will apply for each device monitored.

4.5 Location Information Services

Location Information Services would be available to any cellular caller by dialing a publicized access number. Provides "Where am I? and how do I get to ...?" type assistance on a charge per call basis. Attendants will be equipped with area maps and directories containing hotels, major buildings, gas stations, restaurants, etc.

4.6 Intelligent Vehicle Highway System (IVHS)

Intelligent Vehicle Highway System refers to a government sponsored initiative to encourage technology developments to improve the flow of traffic on U.S. roads and highways. Potential applications involve monitoring traffic patterns, traffic information systems, toll collections, vehicle speeds, etc. Additional investigation is needed before IVHS services can be evaluated for Service Provider applications. IVHS services are not included in this business case.

4.7 Network Interface Service

The Network Interface Service provides the required interface to cellular network location data for E-911 (PSAP) locations, fleet managers or third party providers of location based services. One service unit can handle a cellular network of up to 100 base stations. Additional service units are required for each increment of 100 base stations.

5.1 Equipment Procurement and Availability

Service Provider engineers have evaluated the cellular location technologies currently available, or soon to be available in the marketplace. On the basis of this evaluation, the equipment developed by Sanders has been chosen as the most cost effective and suitable for use in Service Provider's cellular networks. The Sanders equipment will work with the existing installed base of cellular phones. Production Smart Look™ and Micro Look™ equipment will be available to begin deployment in 1995. Other devices and related services may be made available by Sanders depending on market research and Service Providers interest.

5.2 Vendor Capability - Sanders, A Lockheed Martin Company

Sanders, an operating company of the Lockheed Martin Corporation is engaged in the development, manufacture, sale and support of advanced electronic systems. The company serves a broad range of defense and commercial markets through technologies that include wide-band radio, simultaneous multi-band and multi-protocol radio, and very high speed real time digital signal processing. Sanders also operates one of the few foundries in the U.S. for custom design and production of gallium arsenide monolithic microwave chips.

Sanders has formed a Telecommunications Systems business unit to focus on the development, manufacture and sale of cellular location equipment and other products for the wireless telecommunications industry. Sanders, has approximately 4700 employees and is a wholly owned subsidiary of the Lockheed Martin Corporation.

5.3 Joint Technical Trial

Several Service Providers have arranged to participate jointly with Sanders Telecommunications Systems in technical trials beginning in April 1995. These trials are designed to validate the location technology in an actual operational environment. Sanders has performed extensive testing at its test sites in Nashua, New Hampshire and believes it has replicated the difficult multipath environments. This network is available for industry and FCC evaluations of Smart Look and Micro Look.

5.4 Production and Delivery

Sanders plans Smart Look™ and Micro Look™ production units to be available in 1995. Sanders will manufacture the location products in its own manufacturing facilities and is committed to meeting Service Provider's requirements in a timely manner.

6.1 Product and Service Pricing Strategy

The price estimates in this section reflect the best estimates currently available for market sizing and economic feasibility purposes. They may need to be adjusted as better information becomes available.

6.2 Current Products and Services

The cellular location capability will increase the perceived value of all of Service Provider's service packages, especially the popular Roadside Rescue package. Location capability will be illustrated and highlighted in advertising to stimulate demand and reduce the need for price oriented promotions thereby allowing the Service Provider to realize an average monthly revenue per subscriber of at least $2- $4 higher than would otherwise be the case

The importance of location capability is illustrated by the results of a survey by Public Opinion Strategies of Alexandria, Va. as reported by the CTIA. Safety and security were cited as the main reason for purchasing mobile phones by 62 percent of the users. That's nearly twice the number who said they purchased their phone for business or convenience and almost half the people surveyed said they had used their phone to report car trouble, medical emergencies, crimes or drunk drivers. A recent article by Clement J. Driscoll of C. J. Driscoll & Associates, reports that some 25% of callers to 911 are unable to identify their location.

Service provider's service packages have been under increasing price pressure with the average monthly bill decreasing from $84.00 in 1990 to $59.00 in 1994. As stated above the addition of location capability will tend to mitigate this trend and support a differential of at least $2.00 to $4.00 per month in the average monthly bill. This is compared to the case without location capability.

6.3 New Products and Services

The following prices reflect the estimates currently being used for market research. They should provide reasonable estimates for market sizing and economic feasibility purposes, but may need to be adjusted as better information becomes available.

	Resale Price	Maint Contract/Mo.	Monthly Lease Option
Micro Look™ - mobile or handheld portable cellular locator designed for use by emergency and law enforcement agencies.	$15,000	$TBD	Yes

	Resale Price	Activation Fee	Monthly Monitoring Svc
Vehicle Alarm Device - theft detection/location device for installation in vehicles.	$350	$40	$20

	Resale Price	Activation Fee	Monthly Charge* Per Device
Fleet Management Device - fleet location device for installation in vehicles.	$350	$40	$2

* Additional charges apply for communications lines to customer premises

	Resale Price	Activation Fee	Monthly Monitoring Svc
Personal Safety Device- signals an emergency and enables location to be determined.	$300	$40	$35

	Monthly Charge* Per Subscriber
Emergency Network (E911 type) Interface Service - provides the required interface to cellular network location data .	$2

* Additional charges apply for communications lines to customer premises

7.1 Financial Analysis

The financial analysis is designed to estimate the impact of deploying the Sanders cellular location equipment on the Service Providers revenues, expenses and capital requirements. The financial displays show the estimated impact on earnings as well as discounted cash flow measurements.

7.2 Reference Case Assumptions

The reference case financial analysis is based on the following assumptions.

- Cellular location capability is provided by Sanders equipment.
- The service area is covered by 125 cell sites - no growth in the reference case.

• There are 125,250 subscribers served by the service provider - no growth in the reference case.

• Each of the 125 sites is fully equipped with TDOA equipment.

• 250 mobile or handheld precision locator devices are purchased with the system for Service Provider use and distribution to public safety organizations in service area.

• The other Service Provider in the area installs location equipment and applies the same price formula thus eliminating any competitive advantage or disadvantage as a result of deploying cellular location support for E911.

• The discount rate for discounted cash flow analysis is 13%.

• Service providers tax rate is 34%.

• The location equipment is installed in 1995.

• Price change increases the average cellular bill by $2.65.

• The equipment is viable through the year 2002.

• The positive value added benefits of E911 location capability offset the negative effect of a price increase resulting in no net change in demand resulting from the introduction of location capability.

7.3 Growth and New Services Assumptions

The reference case assumption set (Case 1) provides an estimate of the cost to equip the installed base and estimates the time required to recover that cost from existing customers based on a discounted cash flow analysis. The Case 2 assumptions shown in Table 1 overlay the effects of subscriber growth and revenue from possible new products and services. Provisions are also made for growth in cell sites.

7.4 Financial Analysis

The results of applying the reference case assumptions are shown in Figures 1 and 2. An investment of $13.5 million is required to install the location equipment and the additional revenue produces a payback in about 7 years on a discounted cash flow basis.

Figures 3 and 4 show the results of overlaying the subscriber growth and new services assumptions. The discounted payback period is reduced by about 2 years, and the Internal Rate of Return is increased from 13.7% to 23.6% and the NPV in 2002 is increased from $212,000 to $3,977,000.

Figures 5 and 6 show the results obtained by eliminating the price increase of $2.65 per month and including only the revenues from new products and services. There is no payback within the 8 year study and the NPV is a negative $15,360,000.

8.1 Conclusions

From this analysis using Case 1 assumptions, we conclude that the investment in location equipment can be justified by a surcharge or price increase of about $2.65 per month. Variations in service areas, equipment configurations, subscriber density, etc would all impact this result, however a range from $2.50 to $4.00 per month is estimated to cover most situations.

Although the research is incomplete to support market forecasts for the new products and services discussed, Case 2 illustrates that additional revenue from new location related products and services would reduce the level of surcharge or price increase needed. This along with continuing subscriber growth would permit providers to reduce the surcharge over time as additional sources of revenues allow.

Case 3 illustrates the difficulty involved in achieving a reasonable financial return using only the new product and service revenue. The investments in location equipment are immediate, while the revenue streams are subject to all the delays and difficulties associated with introducing new products and creating new markets.

Figure 1

	CASH FLOW ($000)							Discounted Cash Flow Analysis - Case 1 Assumptions
Year	1995	1996	1997	1998	1999	2000	2001	2002
Revenue	3,319	3,983	3,983	3,983	3,983	3,983	3,983	3,983
Cash Flow Expense	619	921	921	921	921	1,146	921	921
Plant & Equipment	13,528	0	0	0	0	0	0	0
Interest Expense	0	0	0	0	0	0	0	0
Pre-Tax Cash Flow	(10,828)	3,062	3,062	3,062	3,062	2,837	3,062	3,062
Income Tax Effect	0	70	394	556	677	768	836	888
Net Cash Flow	(10,828)	2,992	2,668	2,506	2,385	2,068	2,226	2,175
Discounted Cash Flow	(10,186)	2,491	1,965	1,634	1,376	1,056	1,006	870
CDCF	(10,186)	(7,695)	(5,729)	(4,096)	(2,720)	(1,663)	(658)	212
Summary Measures								
NPV ($000)	212							
IROR =	13.7%							
Discounted Payback Yr.	2002	7	Years					

Figure 2

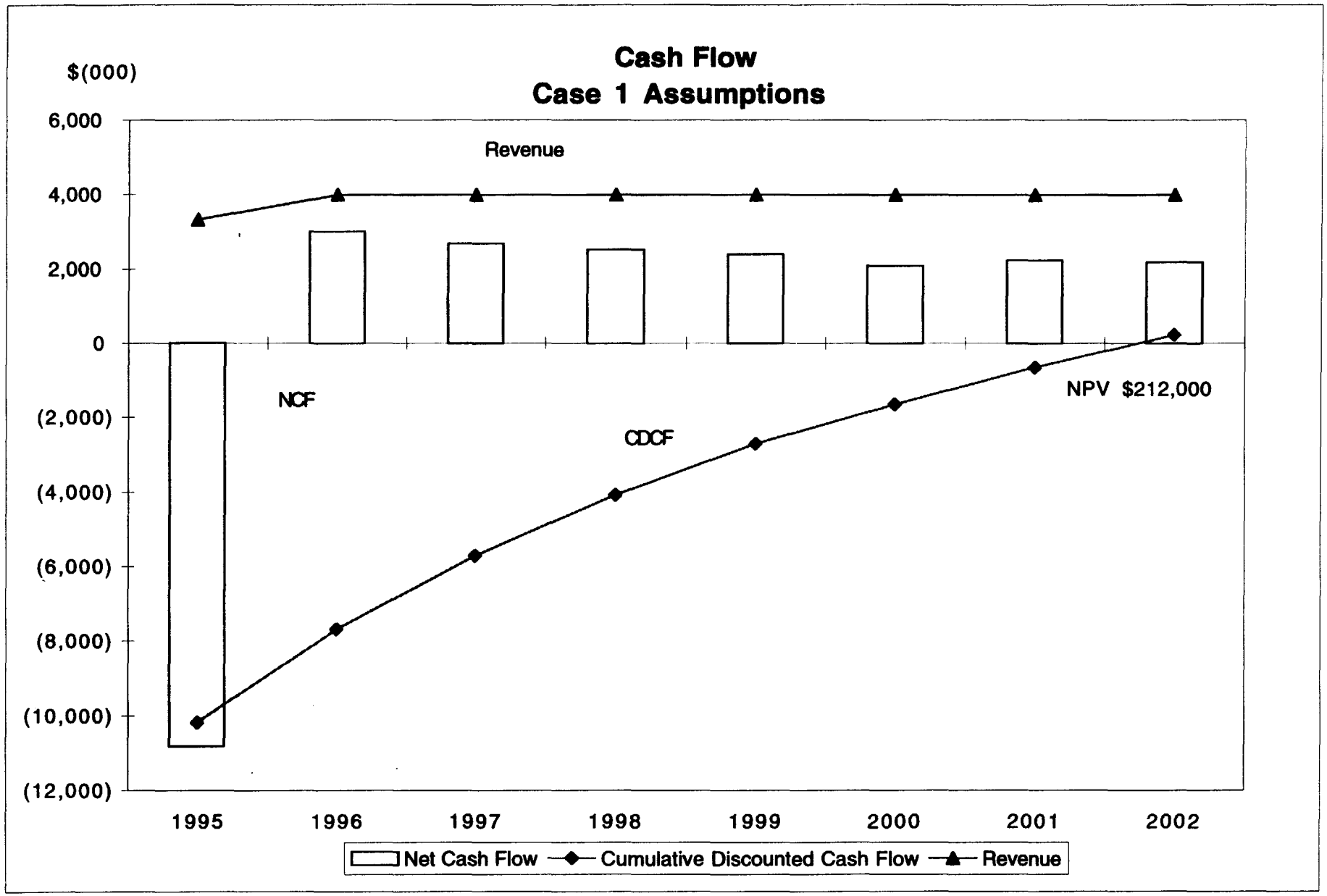

Cash Flow
Case 1 Assumptions
$(000)
6,000
4,000
2,000
0
(2,000)
(4,000)
(6,000)
(8,000)
(10,000)
(12,000)
Revenue
NCF
CDCF
NPV $212,000
1995
1996
1997
1998
1999
2000
2001
2002
Net Cash Flow
Cumulative Discounted Cash Flow
Revenue

Figure 3

	CASH FLOW ($000)						Discounted Cash Flow Analysis - Case 2 Assumptions	
Year	1995	1996	1997	1998	1999	2000	2001	2002
Revenue	3,319	6,009	6,831	8,613	10,685	10,317	10,017	10,654
Cash Flow Expense	613	2,047	2,427	3,310	4,391	4,100	3,273	3,313
Plant & Equipment	13,960	600	683	740	786	824	857	887
Interest Expense	0	0	0	0	0	0	0	0
Pre-Tax Cash Flow	(11,254)	3,363	3,721	4,562	5,509	5,393	5,887	6,454
Income Tax Effect	0	256	766	1,191	1,631	1,788	1,916	2,128
Net Cash Flow	(11,254)	3,107	2,956	3,371	3,878	3,605	3,971	4,326
Discounted Cash Flow	(10,587)	2,586	2,177	2,198	2,237	1,841	1,794	1,730
CDCF	(10,587)	(8,001)	(5,823)	(3,626)	(1,388)	453	2,247	3,977

Summary Measures			
NPV ($000)	3,977		
IROR =	23.6%		
Discounted Payback Yr.	2000	5	Years

Figure 4

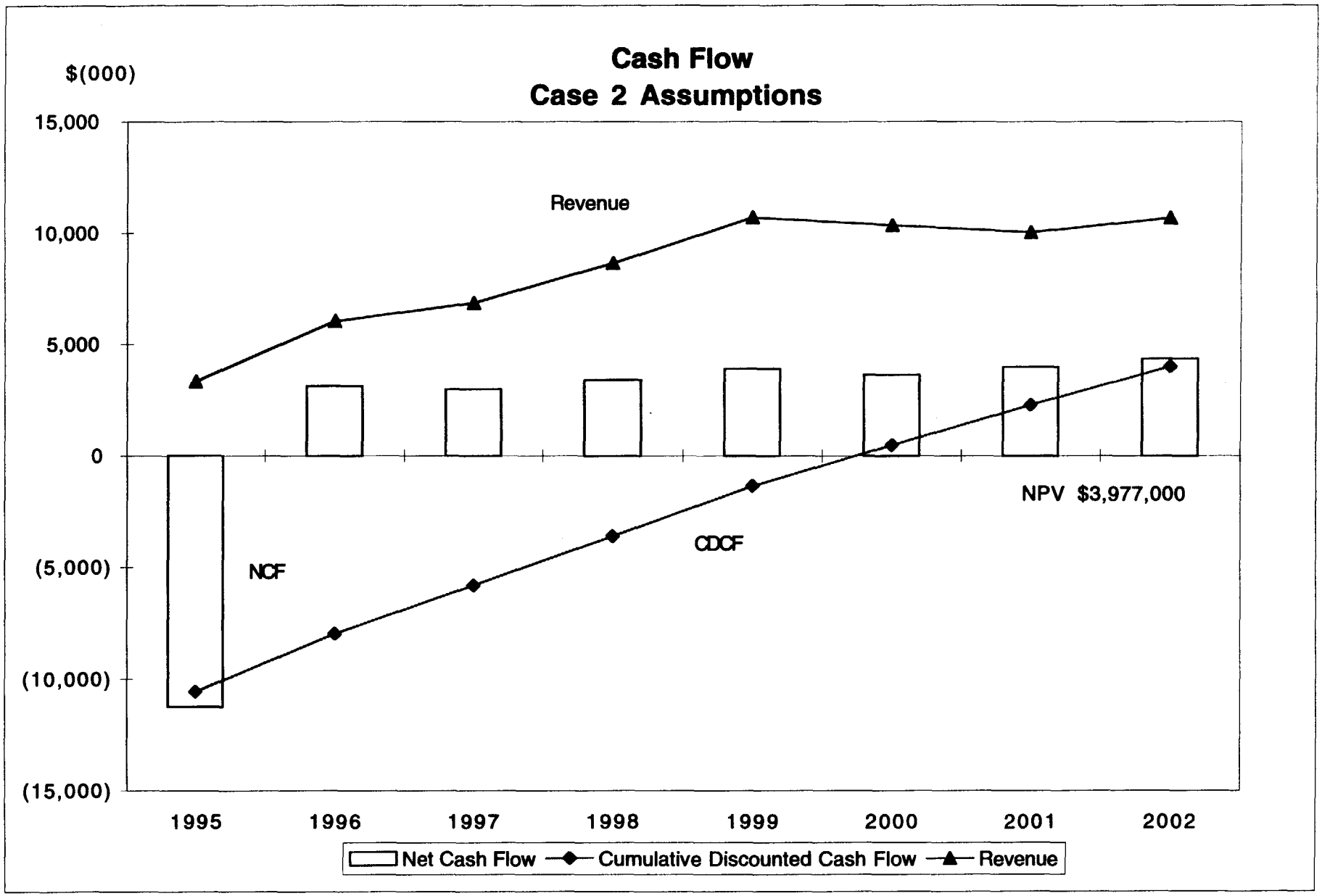
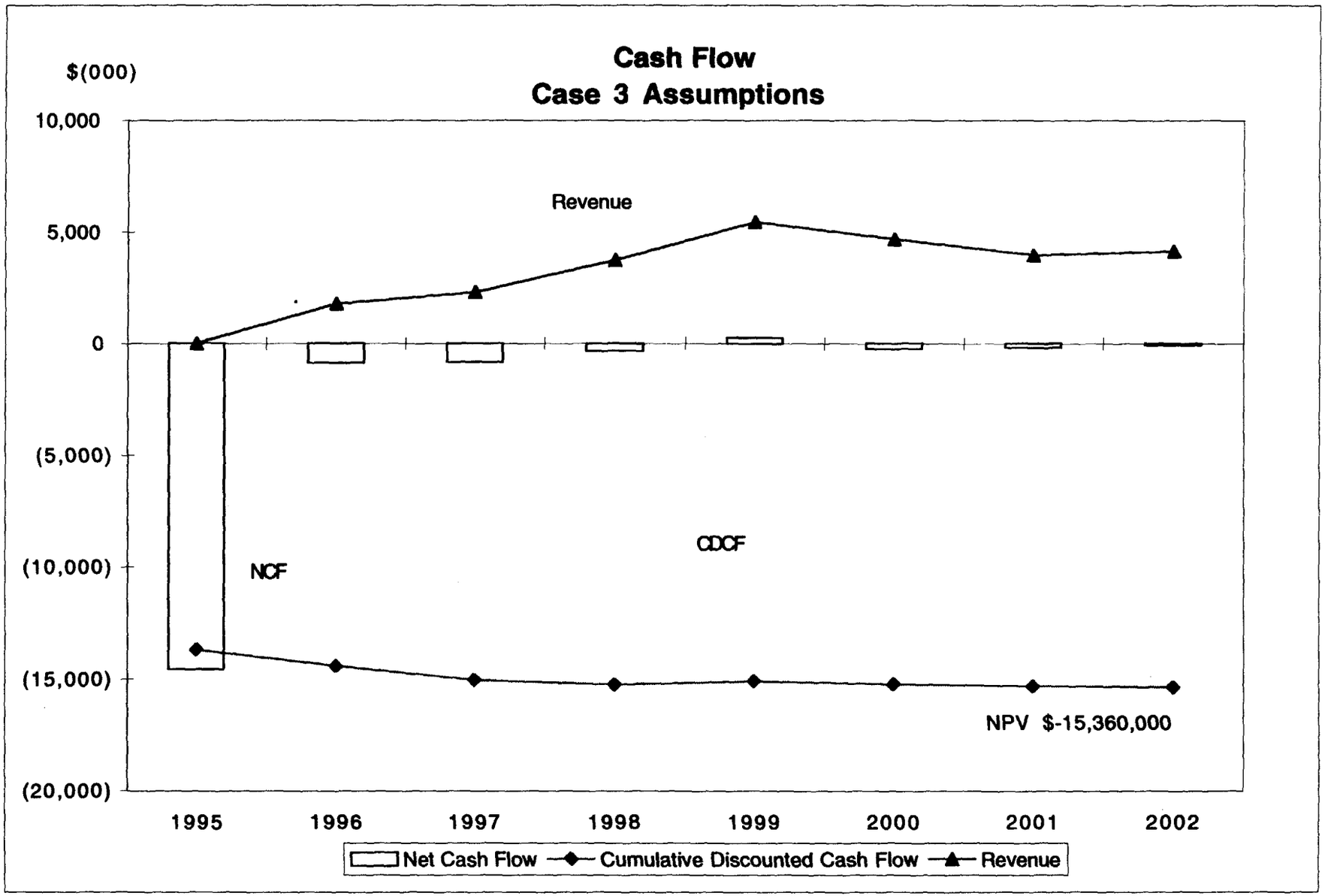

Cash Flow
Case 2 Assumptions
$(000)
15,000
10,000
5,000
0
(5,000)
(10,000)
(15,000)
Revenue
NCF
CDCF
NPV $3,977,000
1995
1996
1997
1998
1999
2000
2001
2002
Net Cash Flow
Cumulative Discounted Cash Flow
Revenue

Figure 5

	CASH FLOW ($000)				Discounted Cash Flow Analysis - Case 3 Assumptions			
Year	1995	1996	1997	1998	1999	2000	2001	2002
Revenue	0	1,777	2,281	3,722	5,428	4,665	3,942	4,123
Cash Flow Expense	613	2,047	2,427	3,310	4,391	4,100	3,273	3,313
Plant & Equipment	13,960	600	683	740	786	824	857	887
Interest Expense	0	0	0	0	0	0	0	0
Pre-Tax Cash Flow	(14,573)	(869)	(828)	(328)	252	(259)	(189)	(77)
Income Tax Effect	0	0	0	0	0	0	0	0
Net Cash Flow	(14,573)	(869)	(828)	(328)	252	(259)	(189)	(77)
Discounted Cash Flow	(13,710)	(724)	(610)	(214)	145	(132)	(85)	(31)
CDCF	(13,710)	(14,433)	(15,043)	(15,257)	(15,112)	(15,244)	(15,329)	(15,360)
Summary Measures								
NPV ($000)	(15,360)							
IROR =	na							
Discounted Payback Yr.	None	∞	Years					

Figure 6


Cash Flow
Case 3 Assumptions
$(000)
10,000
5,000
0
(5,000)
(10,000)
(15,000)
(20,000)
Revenue
NCF
CDCF
NPV $-15,360,000
1995
1996
1997
1998
1999
2000
2001
2002
Net Cash Flow
Cumulative Discounted Cash Flow
Revenue